COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
FRANKFORT

March 21, 1960

EARLE C. CLEMENTS
COMMISSIONER OF HIGHWAYS

ADDRESS REPLY TO
DEPARTMENT OF HIGHWAYS
MATERIALS RESEARCH LABORATORY
132 GRAHAM AVENUE
LEXINGTON 29, KENTUCKY

P.2.1.

MEMO TO: A. O. Neiser
Assistant State Highway Engineer

SUBJECT: Proposed Specification for Bridge Paints

On July 30, 1958, two proposed bridge paint system specifications were submitted by this Division for Department consideration. Since that time, there have been several discussion sessions between various paint industry representatives, members of the Department Specifications Committee, and J. H. Havens, Assistant Director of Research. Mr. Havens has been requested by the Specifications Committee to re-write one of the specifications, BASIC LEAD SILICO-CHROMATE, OIL-ALKYD PAINT SYSTEMS FOR IRON AND STEEL STRUCTURES (BRIDGES), and to prepare an additional specification covering, PHENOLIC RESIN PENETRATING LIQUID PAINT SYSTEM FOR IRON AND STEEL STRUCTURES (BRIDGES).

Proposed specifications covering the two requested paint systems have been prepared and are attached. Mr. Havens in his memorandum has outlined the most important items concerning the development of the two paint systems, and further recommends that the vinyl paint system covered earlier in the proposed specification, BASIC LEAD SILICO-CHROMATE, VINYL AND VINYL-ALKYD PAINT SYSTEM WITH PRETREATMENT WASH PRIMER FOR IRON AND STEEL STRUCTURES (BRIDGES), submitted July 30, 1958, be considered further for some experimental use on the floor members and splash areas subject to the action of salts or persisting moisture conditions. The vinyl system requires sand blasting or cleaning to bright metal and therefore is quite expensive and should be evaluated by comparison with the other systems in a test installation.

We are submitting additional copies of the specifications for distribution to the Specifications Committee.

W. B. Drake
Associate Director of Research

WBD:dl
Att.
cc: T. J. Hopgood
E. D. Smith

COMMONWEALTH OF KENTUCKY
DEPARTMENT OF HIGHWAYS
FRANKFORT

March 18, 1960

EARLE C. CLEMENTS
COMMISSIONER OF HIGHWAYS

ADDRESS REPLY TO
DEPARTMENT OF HIGHWAYS
MATERIALS RESEARCH LABORATORY
132 GRAHAM AVENUE
LEXINGTON 29, KENTUCKY

CONFIDENTIAL

P.2.1.

MEMO TO: W. B. Drake
Associate Director of Research

SUBJECT: Bridge Paint Specifications

About two years ago, July, 30, 1958, we offered a set of proposed specifications to the Specifications Committee for consideration in particular regard to the Clark Memorial Bridge and the severe conditions there, within the splash zones, caused by the use of de-icing salts. As you may recall, we proposed the use of a vinyl-alkyd base paint with basic-lead silico-chromate pigment (required sand-blasting and wash primer) in the critical zones; and above the critical zones we proposed the use of oil-alkyd base paint, also with basic lead silico-chromate pigment. It was mentioned in our letter of conveyence that our foremost objective was to combine a highly anti-corrosive pigment with a highly impermeable vehicle (binder). We selected the vinyl-system, with basic lead silico-chromate, as offering considerable merit in this respect. However, it was mentioned that phenolic varnish vehicles and epoxy-type vehicles were similarly considered as superior to linseed oil and oil-alkyds under severely corrosive circumstances.

Also, about 2 years ago the DuPont Company in correspondence with Mr. Hopgood, May 16, 1958, mentioned that their "Delux" Metal Protective Primer and Aluminum were used in re-painting the Louisville bridge in 1935, 1941 and 1946. Although the correspondence does not mention the vehicle types used in those paints, it is presumed that they were oil and oil-alkyds or phenolics. The writer, Mr. Frank Smith, Manager, Industrial Sales Maintenance, says:

> "Both the Phenolics and the Epoxy Chemical Resistant Coatings develop very hard, highly impermeable films. As is characteristic of such films on exterior exposure, they lose gloss rather rapidly and chalk faster than conventional alkyd bridge paints when exposed to sunlight."

This has been our understanding also. Additionally, it has been our understanding that phenolics tend to "yellow" rather badly with age and that they should be used preferably in dark-colored paints in which "yellowing" would not cause visible alteration of the original color. None of these resins, i.e., alkyds, phenolics, vinyls, or epoxies,seem to perform as well in the "pure" form as they do in the oil-modified, plasticized, or blended forms. Thus, brittleness and other unfavorable properties of a resin often may be overcome by blending with other resins and plasticizers.

In order to provide additional background information on the problem in general, reference is made to a communication addressed to Mr. E. D. Smith, February 21, 1958, by F. W. Panhorst of the California Department of Public Works. Mr. Panhorst indicated that their usual procedure for painting coastal bridges was:

1. Sandblast to bright metal.
2. Apply one coat of vinyl wash primer.
3. Apply 4 mils (2 coats) of quick drying red lead (oil-alkyd vehicle) undercoat.
4. Apply 2 mils of Flaked aluminum in phenolic varnish vehicle (tung oil-modified).

However, he went on to say:

> "We feel that vinyl paint system is very promising for marine exposures. Full field tests so far indicate equal if not better performance than the above system. Due to their low solids content, several coats are required to build up the necessary thickness. We feel 6 mils are required for marine exposure. Specifications for the vinyls are also attached. With vinyls, thorough cleaning and pre-treatment is a must."

Our selection of a vinyl system for use within the splash zone was predicted largely upon Mr. Panhorst's statement and the recommendation of the National Lead Company. Our contact with the National Lead Company resulted from some rather overwhelming evidence they offered, in the form of test-fence performance, indicating a superiority of basic lead silico-chromate over red lead as a corrosion inhibitor.

This brings us to the discussion of Mr. O. F. Shobe's recommendations*. The only thing that seems to be unique about Mr. Shobe's

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* Shobe, Owen F., "An Innovation in Painting Steel," Paper presented before the Bridge Division, AASHO, Philadelphia, May 21-22, 1959; Also, misc. correspondence addressed to Mr. Bray and to Mr. Smith transmitting LIA Formulas 2612, 2614, 2615A, 2620, 2628, 2633, 2648, and 2644.

formulations is the use of "Phenolic Resin Penetrating Liquid." We understand that paint technologists are almost categorically in favor of improving the wetting characteristics of primers, particularly where the metal is not thoroughly cleaned. Wetting has always been one of the inherent virtues of linseed oil and doubtlessly this quality has helped to establish red-lead linseed oil primers as a more-or-less traditional standard. Rust-Oleum, a processed fish oil paint, claimed exceptional merits with respect to wetting and penetration through rust and scale on uncleaned metal. While some attendant claims, particularly the idea that it isn't necessary to remove scale, have been repudiated, the fact remains that good wetting and adhesion is an essential quality in primer vehicles even on thoroughly cleaned metal. This accounts for the necessity for using the wash primer with vinyl-type paints.

We understand also that Mr. Shobe's formulations have shown exceptional performance in laboratory tests; but we feel that the comments made by the Bureau of Public Roads* in response to a formal

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*Communication addressed to D. H. Bray, May 13, 1959, from J. C. Cobb quoting Mr. Harold Allen, Chief of the Division of Physical Research.

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inquiry might be interpreted as being precautionary. In part, it said:

> "Mr. Shobe's demonstration, based primarily on laboratory tested panels, indicates that the new formulation may have considerable merit. Unfortunately, we have no supporting field data of our own, nor has any been provided us by Mr. Shobe. Consequently, at the present time, we have no basis for a definite recommendation concerning the probable quality of this new paint in comparison with paints now used."

However, Mr. Allen went on to say:

> "On the basis of the evidence presented by Mr. Shobe (presumably laboratory test results), we believe that the paint merits further study and we are very much interested in seeing it used in experimental projects. Other promising new paints such as those using basic-lead-silico-chromate as the inhibitive pigment might also be considered for experimental work."
>
> "If Kentucky wishes to establish such an experimental project, we would be glad to cooperate in any way possible."

As mentioned earlier, our original recommendation and specifications were based, in part, upon the basic-lead silico-chromate system to which Mr. Allen also referred.

It appears that there has been some conflicting interests within the Lead Pigments Technical Committee of the Lead Industries Association. The National Lead Company, a member company of the Lead Industries Association was the originator and developer of basic lead-silico-chromate. Naturally, the interest of this company would center around its own product. On the other hand, Mr. Shobe, we understand, was with the Glidden Company for many years before his retirement or before assuming his closer affiliation with the Lead Pigments Technical Committee of LIA. It has been called to our attention that the so-called "Phenolic Resin Penetrating Liquid," which comprises 30% to 40% of the vehicle in some of his formulations, is a Glidden Company product, presently covered by patent application. We have noted, however, that some of Mr. Shobe's formulations include basic lead silico-chromate in combination with red lead and other pigments.

Mr. Shobe visited our office on July 8th, and exhibited several test panels which seemed to provide a rather impressive substantiation of his claims concerning wetting and penetration. We mentioned to him our prior interest in the vinyl system for use in the splash zones, and he concurred in our thought that they offered, by far, the best hope for complete protection. However, it was his thought that a pure vinyl system would cost us much as four times more than his phenolic system (largely in labor and number of coats required, difficult to spray or brush, low film forming solids) and as much as two and one-half times as much as the vinyl-alkyd system which we proposed. He did not believe that the extra cost would be justified.

Mr. Shobe held the belief that the primer pigment should be comprised almost entirely of red lead (LIA Formula 2614) in order to avoid blistering (salt spray test). However, in the intermediate and finish coats, he conceded the opinion that basic lead silico-chromate would perform satisfactorily.

It may be of interest to record here that C. P. Kroboth, Consulting Engineer, acting in behalf of the owners of the toll bridge at Kermit, Kentucky, after some discussion with Mr. Smith, me and the Glidden Company, chose to specify Mr. Shobe's type of paint for repainting that bridge. I understand that the job was completed satisfactorly early last fall.

I talked again with Mr. Shobe at the Highway Research Board meeting in Washington last January. He informed me that his activities with the LIA Lead Pigments Committee had been curtailed somewhat because of conflicting interests between himself and the National Lead Company. He was perseverant in promoting the use of Phenolic Resin Penetrating Liquid. I had hoped to obtain agreement between these people and to obtain a concerted recommendation that would combine the desireable qualities of basic lead silico-chromate with the Phenolic Resin Penetrating Liquid. No such agreement seems to be forth-coming, but this story may serve to explain some of the delay in submitting these specifications.

At a meeting in Mr. Smith's office in February (Mr. Collier and Mr. Hopgood were present), the foregoing circumstances were reiterated, and it was agreed that I would proceed with the adaptation of Mr. Shobe's formulations to the form of a proposed special specification and that the National Lead Company's oil-alkyd, Basic Lead Silico-Chromate formulation originally proposed for use above the splash zone be re-edited and re-submitted. The intent then was to use these paints more-or-less experimentally, using our 7.23.4-B Foliage Green as a reference, on the Clark Memorial Bridge.

Due note is now taken of the fact that the oil-alkyd, Basic Lead Silico-Chromate system was not originally recommended for specific use in the splash-zone, and it is not so recommended now. This is because the general thinking of paint people leans more toward the phenolics, vinyls, and epoxies for such uses regardless of the pigment. For instance, a tung-oil modified phenolic vehicle in the finish coat at least would probably be preferable to the oil-alkyd vehicle for severe exposure.

There is another point of view that enters into this problem. Whereas a great deal of thought is given to types of vehicles and pigments from the standpoint of durability, the build-up of film thickness (number of coats and application rates) may even over-shadow differences in composition. Four coats (say 8 mils) of one paint might equal the performance of three coats (6 mils or so) of another. The ideal thickness ranges between 6 and 10 mils, but performance also varies within that range. There are some paints which will give more than 3 mils dry thickness per coat.

In summary, our observation is that the Louisville Bridge needs some cleaning and re-painting, particularly within the splash zone. We could, of course, follow our usual procedure and specifications and get the job done, but we would be none the wiser for it insofar as the problem of protecting bridges against splash-zone corrosion is concerned. It seems to us, therefore, that the Department may wish to make a choice somewhat arbitrarily as to the type of paint system to use or else to follow Mr. Allen's lead and establish an experimental project. Such an experimental project might well include any or all of the following:

1. Present Kentucky standard paints.
2. Mr. Shobe's Phenolic-type formulations.
3. The California-type Phenolic formulations.
4. Epoxy resin based paints.
5. Vinyl paint system, as we originally proposed.
6. Vinyl paint system, California type.
7. National Lead Company's oil-alkyd, M.50 system.

We have proceeded with the adaptation of Mr. Shobe's formulations to the usual format of our Department of Highways' Specifications and copies are attached.

Jas. H. Havens
Assistant Director of Research

JHH:dl
Attachments:

1. Proposed Special Spec., patterned after LIA Formulas 2615A, 2614, 2648 and 2644.

2. Proposed Special Spec., patterned after National Lead Company's Defence in Depth M 50 System.

PROPOSED

Commonwealth of Kentucky
Department of Highways

SPECIAL SPECIFICATIONS NO. ____

BASIC LEAD SILICO-CHROMATE, OIL-ALKYD PAINT SYSTEM FOR IRON AND STEEL STRUCTURES (BRIDGES)

This Special Specification shall be applicable only when indicated on Plans, Proposals, or Bidding invitations and when so indicated shall supersede all conflicting requirements of the Department's 1956 Standard Specifications for Road and Bridge Construction.

I. DESCRIPTION

This specification covers the material requirements for a Basic Lead Silico-Chromate, Oil-Alkyd Paint System intended for use on exterior iron and steel structures (bridges), for either new or repaint work except where exposed to severely corrosive conditions such as within the splash-zone from bridge decks or on other members likely to be affected by de-icing salts or persistent moisture conditions. This system shall consist of primer-, intermediate-, and finish-coat paints as hereafter specified. Uses of the component paints other than as an integral part of this system are specifically excluded.

II. GENERAL REQUIREMENTS

All paints for this system shall be factor mixed, well ground, and ready for use as delivered. They shall not settle badly, gel, or cake in the container; and any sediment occurring shall be easily re-blended with a paddle to produce a smooth, uniform paint of good

brushing consistency. When brushed onto a clean, smooth, vertical, steel panel, the paint shall dry smoothly without running, streaking, or sagging.

All paints shall be delivered in sealed, strong, substantial containers having well secured lids or covers. Each container shall be plainly labeled with the name and address of the manufacturer, contract or purchase order number, specification title and number, type of paint (primer-, intermediate-, or finish-coat), net contents of the container, date of manufacture, and lot or batch number. Unless otherwise specified, all paints shall be furnished in containers having nominal volumes of not more than 5 gallons.

III. SAMPLING AND TESTING

The Department reserves the right to analyze, test, or otherwise acquire information to determine whether or not the products conform to this specification. No paint shall be used without prior approval by the Department's Testing Laboratory. A representative of the Department shall obtain a one-quart sample from each 500 gallons, or portion thereof, comprising each lot, batch, or shipment received on the job. At least ten days shall be allowed for testing and analysis. Any lot, batch, or shipment rejected by the Laboratory shall be removed from the job site before work will be allowed to commence.

IV. MATERIAL REQUIREMENTS FOR PRIMER COAT PAINT

A. Composition of Pigment	Percent by Wt. Min.	Max.
Basic Lead Silico-Chromate (ASTM D 1648-59T)	99.40	
Organo-Montmorillonite (National Lead Co., Bentone 34 or 38)	.30	.60

	Percent by Wt. Min.	Max.
B. Composition of Vehicle		
Raw Linseed Oil (TT-O-369)	60.00	
Alkyd Resin (70% N.V.)(TT-R-266, Type I)	21.50	
Mineral Spirits, Heavy (TT-T-291a)		17.00
Lead Napthenate (24% Pb)(TT-D-643b)	.70	.80
Manganese Napthenate (6% Mn)(TT-D-643b)	.30	.40
Non-Volatiles	75.00	
Phthalic Anhydride in Non-Volatile Vehicle	4.60	

C. Composition and Properties of Paint	Min.	Max.
Pigment (% by wt.)	66.0	
Vehicle (% by wt.)		34.00
Non-Volatiles (%by wt.)	91.00	
Coarse particles & skins retained on a 325 sieve (based on the paint)(%)		1.0
Wt. per Gal. (lbs.)	15.5	
Consistency in gms.* (mod. Stormer)	150	200
Equivalent K.U.	72	82
Fineness of grind (Hegeman)	4.0	
Organic dyes	None	
Drying time (hrs.)		18

* The paint shall stand 24 to 28 hrs. after manufacture before the viscosity is measured.

V. MATERIAL REQUIREMENTS FOR INTERMEDIATE COAT PAINT

	Percent by Wt. Min.	Max.
A. Composition of Pigment		
Basic Lead Silico-Chromate (ASTM D 1648-59T)	64.00	
Red Iron Oxide (Siliceous, 85% Fe_2O_3) (Williams, R 3098, or equal)		35.70
Organo-Montmorillonite (National Lead Co., Bentone 34)	.30	.60

B. Composition of Vehicle

	Percent by Wt. Min.	Max.
Raw Linseed Oil, (TT-O-369)	48.00	48.50
Alkyd Resin Solution (70% N.V.) (TT-R-266, Type I)	35.00	35.50
Mineral Spirits, Heavy (TT-T-291a)	15.00	15.50
Lead Napthenate (24% Pb)(TT-D-643b)	.60	.70
Manganese Napthenate (6% Mn)(TT-D-643b)	.30	.40
Anti-Skinning Agent (Guaiacol)	.10	.20
Non-Volatiles	72.00	
Phthalic Anhydride in Non-Volatile Vehcile	7.60	

C. Composition and Properties of Paint

	Min.	Max.
Pigement (% by wt.)	62.0	38.0
Vehicle (% by wt.)	95.00	
Non-Volatiles (% by wt.)		
Coarse particles & skins retained on a 325 sieve (based on the paint)(% by wt.)		1.0
Weight per gallon (lbs.)	14.8	
Consistency in gms.* (Mod. Stormer)	160	210
Equivalent K.U.	74	84
Fineness of grind (Hegeman)	4	
Organic dyes	None	
Drying time (hrs.)		18

* The paint shall stand 24 to 48 hrs. after manufacture before viscosity is measured.

VI. MATERIAL REQUIREMENTS FOR FINISH-COAT PAINT (GREEN)

A. Composition of Pigment

	Percent by Wt. Min.	Max.
Basic Lead Silico-Chromate (ASTM D 1648-59T)	40.00	
Titanium Dioxide N.C. (TT-T-425a, Type III)	27.40	
Diatomoreous Silica (MIL-S-15191A)		5.00
Phthalocyanine Blue (TT-C-610a, Type I)	.10	
Phthalocyanine Green (duPont's GT 751-D or equal)	.40	
Magnesium Silicate (TT-M-90)	18.00	20.00
Zinc Oxide (TT-Z-301a, Type I)	8.00	10.00
Organo-Montmorillonite (National Lead Co., Bentone 34 or 38)	.40	.70

B. Composition of Vehicle

	Percent by Wt. Min.	Max.
Raw Linseed Oil (TT-O-369)	28.50	29.50
Alkyd Resin Solution (50%N.V.) (TT-R-266a, Type III)	55.50	
Mineral Spirits, Heavy (TT-T-291a, Grade I)	12.00	12.50
Lead Napthenate (24% Pb)(TT-D-643b)	.10	.20
Cobalt Napthenate (6% Co)(TT-D-643b)	.03	.05
Manganese Napthenate (6% Mn) (TT-D-643b)	.06	.08
Anti-Skinning Agent (Guaiacol)	.06	.08
Non Volatiles	56.00	
Phthalic Anhydride in Non-Volatile Vehicle	7.5	

C. Composition and Properties of Paint

	Min.	Max.
Pigment (% by wt.)	49.00	51.00
Vehicle (% by wt.)	75.00	
Non-Volatiles		
Coarse-particle and skins (total retained on No. 325 sieve , % by wt.)		1.00
Wt. per gal. (lbs)	11.9	
Consistency in gms. (Mod. Stormer)	155	185
Equivalent K.U.	73	79
Fineness of Grind (Hageman)	4	
Drying time (hrs.)		24

D. Color

The dry paint film shall match the color of a standard green color chip which shall be furnished by the Department upon request to the Engineer of Specifications. Small amounts of molybdate orange (lead molybdate), chrome yellow, lampblack or titanium dioxide in linseed oil as a medium alkyd, may be added in order to obtain the correct color.

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Commonwealth of Kentucky
Department of Highways

SPECIAL SPECIFICATION NO. ___

PHENOLIC RESIN PENETRATING LIQUID PAINT SYSTEM FOR IRON AND STEEL STRUCTURES (BRIDGES)

This special specification shall be applicable when indicated on plans, proposals or bidding invitations and when so indicated shall supersede all conflicting requirements of the Department's 1956 Standard Specifications for Road and Bridge Construction

I. DESCRIPTION

This specification covers the material requirements for a phenolic resin penetrating liquid paint system for use on exterior iron and steel structures (bridges), for either new or re-paint work. The system shall consist of a primer-, intermediate-, and finish-coat paint as hereafter specified. Uses of the component paints other than as an integral part of this system are specifically excluded.

II. GENERAL REQUIREMENTS

All paints for this system, except the aluminum finish coat paint shall be factory mixed, well ground, and ready for use as delivered. They shall not settle badly, gel, or cake in the container; and any sediment occurring shall be easily re-blended to produce a smooth, uniform paint having good brushing consistency. When brushed into a clean, smooth, vertical, steel panel, the paint shall dry smoothly without running, streaking, or sagging.

All paints shall be delivered in sealed, strong, substantial containers having well-secured lids or covers. Each container shall

be plainly labeled with the name and address of the manufacturer, contract or purchase order number, specification title and number, type of paint (primer-, intermediate-, or finish-coat), net contents of the container, date of manufacture, and lot or batch number. Unless otherwise specified, all paints shall be furnished in containers having nominal volumes of not more than 5 gallons.

III. SAMPLING AND TESTING

The Department reserves the right to analyze, test or otherwise acquire information to determine whether or not the products conform to this specification. No paint shall be used without prior approval by the Department's Testing Laboratory. A representative of the Department shall obtain a one-quart sample from each 500 gallons, or portion thereof, comprising each lot, batch, or shipment received on the job. At least ten days shall be allowed for testing and analysis. Any lot, batch, or shipment rejected by the Laboratory shall be removed from the job site before work shall be allowed to commence.

IV. MATERIAL REQUIREMENTS FOR PRIMER COAT PAINT

	Percent by Wt. Min.	Max.
A. Composition of Pigment		
Red Lead (97% Grade)(TT-R-191a, Type I, Class C, or ASTM D 83-41)	89.00	89.50
Magnesium Silicate (MIL-M-15173, Type B)	7.5	8.0
Diatomaceous Silica (ASTM D 604-42, Type I, or 52-MC-522, Type I)	1.60	1.70
Aluminum Stearate (MIL-A-15206A)	.40	.50
Lithage (JAN-L-1147)	.50	.60
Nuact Paste (44% Pb.)(Nuodex Products Company)	.25	.35

B. Composition of Vehicle

	Percent by Wt. Min.	Max.
Alkyd Resin Solution (70% N.V.) (TT-R-266, Type II, Class A)	36.2	36.5
*Phenolic Resin Penetrating Liquid (82% N.V.)(The Glidden Co., No. 358)	36.9	37.3
Raw Tung Oil (TT-O-395, or ASTM D12-55)	4.70	4.80
Mineral Spirits, (Aromatic, 350-410°F) (TT-N-97(2), Type II, Grade A)	10.2	10.6
Ethylene Glycol Monoethyl Ether (TT-E-781, or ASTM D 331-56)	9.1	9.5
Anti-Skinning Agent (Guaiacol)	.40	.50
Lead Napthenate (24% Pb)(TT-D-643b; or ASTM D600-43, Class B)	1.20	1.30
Manganese Napthenate (6% Mn)(TT-D-643b; or ASTM D600-43, Class B)	.35	.45
Non-Volatile in Vehicle	67.00	69.00
Phthalic Anhydride in Non-Volatile Vehicle	12.92	13.50

* Typical Properties:

Wt. per gal. (lbs.)	7.40-7.44
Viscosity	A minus one bubble to A
Iodine No.	110-120
Saponification No.	135-150
Non-Volatile (% by wt.)	82-83
Rosin or Rosin Derivatives	None
Hydroxyl Value	1.3-1.5
Acid No.	10-12

C. Composition and Properties of Paint

	Min.	Max.
Pigment (% by wt.)	74.1	
Vehicle (% by wt.)		25.9
Non-Volatiles (% by wt.)	89.9	
Wt. per Gal. (lbs.)	21.5	
Viscosity (K.U., 80°F)	80	90
Grind (Hegeman)	4	5
Dry to touch (hrs.)	3	5
Dry to re-coat (hrs.)		24

V. MATERIAL REQUIREMENTS FOR INTERMEDIATE COAT PAINT

A. Composition of Pigment	Percent by Wt. Min.	Max.
Basic Lead Silica-Chromate (ASTM D 1648-59T)	64.50	66.50
Titanium Dioxide, Non-Calking Rutile (TT-T-425a, Type III)	17.00	18.00
Zinc Oxide (Acicular)(ASTM D80-41 or TT-Z-301a, Type I)	5.00	6.00
Magnesium Silicate (TT-M-90 or MIL-M-15173, Type B)	10.00	11.00
Organo-Montmorillonite (National Lead Co., Bentone 34)	.60	1.00
Copper Phthalocyanine Blue (TT-C-610a or ASTM D-963-58T)	.10	.15

B. Composition of Vehicle	Percent by Wt. Min.	Max.
Alkyd Resin Solution (70% N.V.) (TT-R-266, Type II, Class A)	55.50	56.50
*Phenolic Resin Penetrating Liquid (82% N.V.)(The Glidden Co., No. 358)	26.00	27.00
Mineral Spirits (350-410°F)(TT-N-97(2), Type II, Class A	8.00	9.00
Diacetone Alcohol (O-D-306a)	5.50	6.50
Lead Napthenate (24% Pb)(TT-D-643b; or ASTM D 600-43, Class B)	.90	1.10
Manganese Napthenate (6% Mn)(TT-D-643b; or ASTM D 600-43, Class B)	.20	.30
Zinc Napthenate (8% Zn)(TT-D-643b; or ASTM D 600-43, Class B)	1.40	1.60
Anti-Skinning Agent (Guaiacol)	.40	.50
Non-Volatile in Vehicle	60.00	62.00
Phthalic Anhydride in Non-Volatile Vehicle	16.00	16.50

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* Typical Properties:

Wt. per Gal. (lbs.)	7.40-7.44
Viscosity	A minus one bubble to A
Iodine No.	110-120
Saponification No.	135-150
Non-Volatiles (% by wt.)	82-83
Hydroxyl Value	1.3-1.5
Acid No.	10-12
Rosin or Rosin Derivatives	None

C. Composition and Properties of Paint

	Min.	Max.
Pigment (% by wt.	53.00	54.00
Vehicle (% by wt.)	47.00	46.00
Non-Volatiles (% by wt.)	82.00	
Wt. per Gal. (lbs.)	13.00	
Viscosity (K.U., 80°F)	80.00	90.00
Grind (Hegeman)	5	6
Dry to touch (hrs.)	3	5
Dry to re-coat (hrs.)		24

VI. MATERIAL REQUIREMENTS FOR FOLIAGE GREEN FINISH COAT PAINT

A. Composition of Pigment

	Percent by Wt. Min.	Max.
Basic Lead Silico-Chromate (ASTM D 1648-59T)	44.50	46.00
Titanium Dioxide, Non-Chalking Rutile (TT-T-425a, Type III)	29.5	31.00
Zinc Oxide (Acicular)(ASTM D80-41 or TT-Z-301a, Type I)	9.00	10.00
Magnesium Silicate (TT-M-90 or MIL-M-15173, Type B)	14.00	15.00
Copper Phthalocyanine Green (DuPont's GT751-D or equal)	.70	
Organo-Montmorillonite (National Lead Co., Bentone 34)	.70	1.00

B. Composition of Vehicle

	Percent by Wt. Min.	Max.
Alkyd Resin Solution (70% N.V.) (TT-R-266, Type II, Class A)	67.50	68.50
*Phenolic Resin Penetrating Liquid (82% N.V.)(The Glidden Co. No. 358)	14.50	15.50
Mineral Spirits (350-410°F)(TT-N-97(2), Type II, Grade A)	8.00	9.00
Diacetone Alcohol (O-D-306a)	5.50	6.50
Lead Napthenate (24% Pb.)(TT-D-643a, or ASTM D600-43, Class B)	.75	.85
Manganese Napthenate (6% Mn)(TT-D-643b, or ASTM D600-43,Class B)	.20	.30
Zinc Napthenate (8% Zn)(TT-D-643b, or ASTM D600-43, Class B)	1.50	1.60
Anti-Skinning Agent (Guaiacol)	.40	.50
Non-Volatile in Vehicle	60.00	
Phthalic Anhydride in Non-Volatile Vehicle	18.50	20.00

* Typical Properties:

Wt. per Gal. (lbs.)	7.40-7.44
Viscosity	A minus one bubble to A
Iodine No.	110-120
Saponification No.	135-150
Non-Volatiles (% by wt.)	82-83
Hydroxyl Value	1.3-1.5
Acid No.	10-12
Rosin or Rosin Derivatives	None

C. Composition and Properties of Paint

	Min.	Max.
Pigment (% by wt.)	45.00	46.00
Vehicle (% by wt.)	54.00	55.00
Non-Volatiles (% by wt.)	77.5	
Wt. per Gal. (lbs.)	12.00	
Viscosity (K.U., 80°F)	72	80
Grind (Hegeman)	6	7
Dry to touch (hrs.)	3	5
Dry to re-coat (hrs.)		24

D. Color

The dry paint film shall match the color of a standard green color chip which shall be furnished by the Department upon request to the Engineer of Specifications. Small amounts of molybdate orange (lead molybdate), chrome yellow, lampblack, or titanium dioxide in linseed oil, as a medium alkyd, may be added in order to obtain the correct color.

VII. MATERIAL REQUIREMENTS FOR ALUMINUM FINISH COAT PAINT

Pigment and vehicle for this paint shall be packaged separately, in two-compartment containers, such that the contents when mixed will yield the specified composition and volume of paint. The pigment and vehicle shall be mixed just prior to use so that the paint used each day will be freshly mixed.

A. Composition of Pigment	Percent by Wt. Min.	Max.
Aluminum Paste (65% wt.) (TT-A-468a, Type II, Class B)	100.00	

B. Composition of Vehicle

	Percent by Wt. Min.	Max.
Alkyd Resin Solution (70% N. V.) (TT-R-266, Type II, Class A)	50.50	51.50
*Phenolic Resin Varnish (40% N.V.)	20.50	21.50
**Phenolic Resin Penetrating Liquid (82% N.V.)(The Glidden Co., No. 358)	11.50	12.50
HiFlash Coal Tar Naptha (315-375°F)	8.50	9.00
Diacetone Alcohol (O-D-306a)	6.00	6.50
Anti-Skinning Agent (Guaiacol)	.20	.30
Cobalt Napthenate (6% Mn)(TT-D-643b, or ASTM D 600-43, Class B)	.15	.25
Manganese Napthenate (6% Mn)(TT-D-643b, or ASTM D 600-43, Class B)	.30	.50
Non-Volatile (% by wt.)	55.00	
Wt. per Gal (lbs.)	7.25	

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* Typical Composition:

Phenolic Resin (Bakelite BR 9400)	80 lbs.
Phenolic Resin (Bakelite BR 4036)	20 lbs.
Tung Oil (TT-O-395 or ASTM D12-55)	25 gal.
Heat Bodied Linseed Oil (TT-O-367)	3 gal.
Mineral Spirits, Aromatic (320-39°F) (TT-N-97(2), Type II, Grade A)	10 gal.
Mineral Spirits (300-400°F)(TT-N-97 (2), Type II, Grade A)	65 gal.

** Typical Properties:

Wt. per Gal (lbs.)	7.40-7.44
Viscosity	A minus one bubble to A
Iodine No.	110-120
Saponification No.	135-150
Non-Volatile (% by wt.)	82-83
Hydroxyl Value	1.3-1.5
Acid No.	10-12
Rosin or Rosin Derivatives	None

C. Composition and Properties of Paint

	Min.	Max.
Pigment Paste (% by wt.)	24.00	25.00
Vehicle (% by wt.)	75.00	76.00
Non-Volatiles (% by wt.)	65.00	
Wt. per Gal. (lbs.)	8.5	
Viscosity (No. 4 Ford Cup)(Sec.)	36	39
Dry to touch (hrs.)	6	8
Dry to recoat (hrs.)		24